A PROPOSED SUBSPECIFIC CLASSIFICATION FOR *CUCURBITA PEPO*

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Cucurbita pepo L., a species which includes squashes, pumpkins, and gourds, contains a remarkable degree of variability in fruit characteristics. The edible immature fruits are known as summer squash in North America and marrows in the United Kingdom. The edible mature fruits are known as pumpkins and winter squashes. Fruit forms that are unpalatable and not consumed are known as gourds. As far as has been determined, all forms of *C. pepo* intercross freely.

The bewildering array of forms of *C. pepo* and the lack of barriers to gene exchange among them have hampered recognition of genetic affinities and resulted in no completely satisfactory subspecific botanical, horticultural, or vernacular classification scheme. To quote L.H. Bailey (1929, p. 91): "I hope we may find a way to use the English names with discrimination, and to this end I am in sympathy with the attempt to harmonize them." My objective is to propose a classification of the extant *C. pepo* cultivars grown for culinary purposes (squashes and pumpkins) that would simultaneously reflect genetic affinities and be consistent with both professional and popular terminology.

Fruit shape as the basis for subspecific classification

Quantitatively inherited characteristics are better indicators of genetic affinities than simply inherited characteristics. Characteristics which are constant throughout development and over a wide range of environmental conditions and cultural practices are more useful as tools for classification than characteristics which change during development or whose expression is strongly influenced by environmental or cultural factors. In addition, characteristics useful for classification must be those which are easily observed by those for whom the classification is intended. Fruit shape is the only characteristic of *C. pepo* that combines these features; it is quantitatively inherited (Sinnott, 1935, 1936), is relatively constant over a wide range of conditions and during development (Sinnott, 1932, 1936; Sinnott & Kaiser, 1934), and is easily observed by all those concerned with *C. pepo*, horticulturists and other scientists, growers, produce marketers and the general public alike. Other characteristics, such as fruit size, fruit color, fruit quality, foliage characteristics and allozyme variation, while often associated with particular fruit shapes and of some aid in understanding genetic relationships, are not well suited for a universally acceptable classification scheme, as they are either simply inherited, strongly influenced by non-genetic variation or developmental age, or not readily observable.

History of subspecific classification within Cucurbita pepo

Historically, fruit shape has been one of several characteristics considered for assigning subspecific groupings within Cucurbita pepo.

Duchesne (Lamarck, 1786) was the first to correctly recognize among the huge variety of Cucurbita cultigens the boundary separating C. pepo from other species. He recognized within C. pepo five groups of cultivars, three groups of ornamental gourds and two groups having fruits used for culinary purposes. The latter two were those having fruits with a length to width ratio about equal to or exceeding 1.0, i.e. pumpkins, the "Giraumons" and "Citrouilles", the former said to be distinguished from the latter by a paler, fine-grained pulp, and those having fruits with a length to width ratio decidedly less than 1.0, i.e. scallops, the "Patissons".

Naudin (1856) recognized the validity of the species boundaries within Cucurbita set by Duchesne and elaborated on his treatment of the edible C. pepo as follows: (1) "Courgerons" (Pumpkins) having spherical or oblate fruits, (2) "Citrouilles" (Pumpkins) having oval fruits, that is, longitudinal to equatorial diameter ratio ranging from 1.0 to 2.0, (3) "Giraumons" having fruits with a polar diameter to equatorial diameter ratio exceeding 2.0, mentioned specifically were cocozelle, vegetable marrow, zucchini, crookneck and some elongate gourds, (4) "Patissons" (Scallops) having flattened fruits, and (5) Gourds, four distinct groups being described.

Alefeld (1866) was the first to ascribe formal subspecific nomenclature to C. pepo, and this was based mainly on the treatment of Naudin. Hence the subspecific groups of C. pepo became var. melopepo, var. citrullina, var. giromontia and var. clypeata for the edible forms and var. pomiformis, var. pyriformis, var. ovifera and var. verrucosa for the gourd forms. The various cultivars of the groups were also assigned Latin names, there being 66 in all.

Bailey (1929) condensed the formal treatment of Alefeld into three subspecific groups: C. pepo var. ovifera (gourds), C. pepo type subspecies (pumpkins, acorns, vegetable marrows), and C. pepo var. melopepo, including var. melopepo clypeiformis (scallops), var. melopepo torticollis (crooknecks) and var. melopepo varia (cocozelles and others).

A North American horticultural treatment was presented by Castetter (1925) who recognized as separate groups the Field and Pie Pumpkins, Scallop, Summer Crookneck, Vegetable Marrow (into these were included Cocozelle and Zucchini), Fordhook (a group characterized by fruits that were "short club-shaped and longitudinally grooved") and Table Queen. This treatment has gained some acceptance (Whitaker & Davis, 1962). However, events which ensued relatively soon after this treatment quickly rendered it out of date. The first of these events was the decline and near disappearance of the Fordhook group (Tapley et al. 1937). Other events were the quick rise of new groups, such as the Zucchini. Even as early as 1937 in the U.S.A., Tapley et al.

considered the zucchini cultivars to constitute a group distinct from the vegetable marrows. More recently, in the U.S.D.A. standards for grading of summer squash, first published in 1945 (U.S.D.A., 1967), five summer squash types were listed: Zucchini, Cocozelle, Crookneck, Straightneck, and Scallop. A total of six summer squash types, these five plus the Vegetable Marrow, were recognized in a U.S.D.A. guide to growers (U.S.D.A., 1969). The increase in number of recognized types of summer squash and the decline of the Fordhook group indicate that Castetter's grouping is no longer an adequate representation of the C. pepo forms presently in commerce.

Cultivar groupings and subspecific designations

Following are the proposed modern horticultural groups of edible Cucurbita pepo based on fruit shape, with a description of the fruit shape characteristics and an accompanying illustration for each group (Figure 1). One or more non-hybrid cultivars have been chosen as typifying each group, not necessarily the oldest or most widely used cultivars but rather homogeneous cultivars still in commerce with which the author has been familiar for several growing seasons. In addition, I will hazard formal botanical subspecific designations, following the subspecific classifications of Alefeld (1866) and Bailey (1929) which relate to fruit shape, with new designations where necessary. No attempt will be made at classifying the gourds, except to suggest that some breakdown of the var. ovifera as treated by Bailey should be desirable as some forms, such as "Spoon" and "Crown of Thorns", have distinct and unusual shapes.

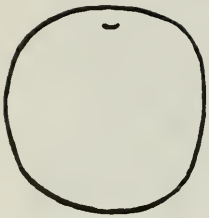
1. Pumpkin. Fruits spherical, oblate or oval, round or flattened at ends. Cultivars include: Connecticut Field, Jack O'Lantern, Small Sugar, Spookie. C. pepo L. var. pepo Bailey. This group represents the type subspecies, for the botanical reasons given by Bailey (1929). The designation is quite fortunate as this group is probably the oldest and most diverse, and because the English word "pumpkin" is derived from the word "pepo".

2. Scallop (syn. Patty Pan). Fruits flattened, almost disc-shaped, with wavy equatorial or nearly equatorial margins. Cultivars include: Benning's Green Tint, Golden Bush Scallop, White Bush Scallop. C. pepo L. var. clypeata Alefeld.

3. Acorn (syn. Table Queen). Fruits shaped like a top, broad at stem end and coming to a point at blossom end, deeply furrowed. Cultivars include: Table Queen, Table King, Mammoth Table Queen, Royal Acorn, Ebony, Jersey Golden Acorn. C. pepo L. var. turbinata ssp. nov. (new subspecific designation) for the top-shaped fruits.

4. Crookneck. Fruits elongate with slim, long, slightly to very curved neck, distal half of fruit broad. Cultivars include: Early Yellow Crookneck, Golden Summer Crookneck. C. pepo L. var. torticollis Alefeld.

5. Straightneck. Fruits cylindrical, with short, slightly constricted neck near stem end and distal half of fruit broad. Cultivars include: Early Prolific Straightneck. C. pepo L. var.



Pumpkin
var. pepo

Scallop
var. clypeata

Acorn
var. turbinata

Crookneck
var. torticollis

Straightneck
var. recticollis

Vegetable Marrow
var. fastigata

Cocozelle
var. longa

Zucchini
var. cylindrica

Figure 1. Fruit shape of each of the eight cultivar groups of Cucurbita pepo. Proximal (stem) end is at top, distal (blossom) end at bottom.

recticollis ssp. nov.

6. Vegetable Marrow. Fruits of short, tapered, cylindrical shape. Gradual taper from narrow at peduncle end to broad at stem end, ratio of length to broadest width ranging from 2.0 to 3.0. Cultivars include: Beirut, Sihi Lavan. C. pepo L. var. fastigata ssp. nov. for the tapered shape of the fruits.

7. Cocozelle. Fruits of long, tapered, cylindrical shape, bulbous near blossom end. Length to broadest width ratio approximating or exceeding 3.5. Cultivars include: Cocozelle. C. pepo L. var. longa ssp. nov.

8. Zucchini (syn. Courgette). Fruits long, cylindrical, with little or no taper, ratio of length to width approximating or exceeding 3.5. Cultivars include: Black Beauty, Black Zucchini, Fordhook Zucchini. C. pepo L. var. cylindrica ssp. nov.

Other fruit shapes exist in C. pepo which cannot readily be included in any one of the above groups. Some of these are intermediate forms, such as the many so-called zucchini hybrids which have long but noticeably tapered fruits. Such hybrids are in reality F_1s between vegetable marrows and zucchinis and thus their intermediate appearance. Other forms are more or less unique. For example, cv. Delicata is perhaps the sole survivor of the Fordhook group of Castetter (1925).

Age of the cultivar groups

Each of the eight cultivar groups appears to have a history dating back at least several hundred years. Pumpkins, scallops and acorns are richly represented in European herbals, notably those of Gerard and Johnson (1636), Bauhin (1651) and Tabernaemontani (1664). Incipient forms of cocozelle, zucchini and vegetable marrow were described by Bauhin (Icon III, p. 219; Zucha major longa, p. 220; Cucurbita turbinata majores albae, pp. 222-223; Cucurbita indica minor, p. 227) and an incipient form of straightneck appears in Tournefort (1700). If the interpretation of funerary vases from Peru as being modeled after C. pepo fruits (Erwin & Haber, 1929) is correct, the crookneck form is over 1000 years old. Refined forms of all groups except the straightneck were described by Naudin (1856) with at least one commercial straightneck cultivar having been introduced before the close of the 19th century (Tapley et al. 1937).

Summary

An attempt has been made at grouping the extant culinary forms of Cucurbita pepo in such a manner as to permit a unified classification for usage by professionals as well as the general public which would also be reflective of genetic affinities. It has been concluded that fruit shape is the only criterion amenable to such a unified subspecific classification. On this basis, the culinary forms of C. pepo have been divided into eight cultivar groups. Botanical designations have been suggested for the groups along with the common names.

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